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EYE IN THE SKY VERSUS PIE IN THE SKY

TO: Colonel F. E. Oder
Ballistic Missile Division

NRO Review Completed.

Dear Fritz: The title of this piece is EYE IN THE SKY VERSUS PIE IN THE SKY

SECTION I: INTRODUCTION

On taking this method of transmitting to you our preliminary thinking in matters affecting the SAMOS Program. Sending this to you in a letter which I myself signed, simultaneously enables me to be informal and to take the entire responsibility for the prejudices, judgements, opinions, and related matters in the material that follows. On the other hand, I would be less than fair in not indicating that all of this represents the synthesis of my own views developed slowly, carefully, over the years, as well paid. It includes of necessity the views of my colleagues in these matters, which they are competent and expert [redacted] As I think over the things we have talked about, the things I have been saying and the sorts of things I am going to recommend, I find much repetition between these things and the matters discussed and written at length in the reports of the Special Studies Committee, 117-L. This brings up a point which I will not make later and which I insert parenthetically at this point; This committee constitutes a [redacted] resource of talent and interest which has not been fully exploited by USAF. Some method must be found to integrate this group more fully emotionally into the satellite program.

I distinguish these remarks about the abilities and competence of the members of this group and the group as a whole, from the numerous other that divorcedmany, part time advisors, voluntary and appointed, from whom you have been afflicted and by whom you have been affected.

This leads me to my first informal comment having to do with the real nature of this program and its management. For numerous valid and peculiar reasons, it has been hard to properly view the satellite effort at BMD. You are not and have not been running a research organization, a requirements organization, a laboratory, or a study effort. You have been heading a project office devoted to what is in effect

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a production program. The result of your actions to get the satellite off the ground and up in the sky where it belongs, coupled with the necessary security measures, the novelty of the system and other factors has resulted in a lack of an R and D Program of follow on systems, a lack of real participation by those elements of the Air Force which at least used to be capable in the past of conducting the R and D necessary to furnish a basis for follow-on programs. ~~I say this despite the nominal participation by WADD.~~

As a result of these factors when we look at your pitifully small office, we see you interposed between a vast ~~gigantic~~, ~~calamrous~~, hungry, industry numbering upwards of 10,000 people - ~~this on one side of you and the other side of you is~~ a vast, clamrous, ~~gigantic~~, group of military officials, civilian officials, voluntary advisors, numerous levels of the government. Some times I wonder who is really steering, if anybody. It is abundantly clear that it is extremely difficult for your small office to ~~control, manage,~~ direct ~~and supervise~~, ~~or control~~ the vast industry ~~that must be responsive to directions without.~~

You will recall that on May 24, last, we delivered to you an extremely informal letter giving ~~you~~ my very first thoughts about how to think about the current crisis and opportunity in SAMOS. ~~Just for the record, we are sending you that as an official letter.) are as Appendix I.~~

This particular letter will ~~probably~~ be lengthy and rambling; the benefits, however, will let you see how our thought has developed and within what spirit we approached the problem at hand. What is the problem?

THE PROBLEM:

We see the major problem ~~you~~ in two parts (1) helping the United States get significant, useful, and timely photographs over important and otherwise inaccessible areas as soon as possible (2) We see the other half of the problem as that of helping BMD comply with the spirit, direction, orders and priorities from Billings at the ~~BMD~~ DOD level, Charyk at USAF, and others:

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(a) Within the SAMOS structure (XX)

(b) Outside the ~~XXXXX~~ SAMOS structure if it is necessary and/or desirable.

~~ASSUMPTIONS, PROMISES AND ANALYSIS OF THE PROBLEM~~

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ASSUMPTIONS, PROMISES AND ANALYSIS OF THE PROBLEM

In order that you can clearly see and evaluate the advice and recommendations which we are slowly but surely leading up to it is only fair to both of us that we display in clear, albeit, arguable form our analysis of the ~~XXXXXX~~ dilemma and the problem (2) our intrepretation of the needs, guidelines, directives and (3) our evaluation of the opportunities we have ~~for us~~.

ANALYSIS OF DILEMMA

Here's how the current situation looks to many people: We have spent close to a billion dollars on a system which has not yet delivered. The essential characteristics of this system are characterized by the word "readout". Read-out is considered by most people who have their hands on the financial throttle as being a poor system when compared to recovery systems. The argument is extraordinarily simple.

Recovery systems can deliver much more data in a short period than can readout systems.

If this is true, how did we get to where we are in the development program? The history is really simple and has been summarized previously and elsewhere in several RAND reports. It is however worth repeating ~~from the standpoint of clarification~~ to clarify our assumptions. The readout systems and body in SAMOS are derivatives in spirit and ~~XXX~~ philosophy from the original RAND satellite recommendations, which was ~~XXXXX~~ constrained by two important factors. First, the absence of ICBM Program, ~~First~~ forced, the RAND work to consider the design and development of a booster specifically for the reconnaissance satellite. This implied expensive boosters and booster scarsity. Both of these points ~~made~~ forced for long life requirements on orbit. Second, and at least as important as the first, dismissial of re-entry or physical recovery of data in the early work. Because of the enormous difficulty of reentry, ~~this~~ this ~~XXXXX~~ was an important constraint ~~XXXXXX~~ affecting decisions to proceed on ICBM's

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as well. ~~Nonconsideration or latter consideration of~~ The belief in the possibility of recovery implied that data had to be sent back by a television system. These were the intellectual origins of SAMOS. It was not generally realized or appreciated that the ~~emergence~~ emergence of the ICBM Program and the multi-billion dollar bet that we had placed on ~~XXXXXXXXXX~~ the likelihood of its success would have removed the two constraints which had bound in the SAMOS ~~XXXX~~ philosophy. This is precisely what has happened and what has made discussions of ~~hard~~ consideration of recovery feasible.

Apart from this ~~very~~ fundamental historical point, there is also the other important point that SAMOS as it has developed is an extraordinarily complicated, complex, marginal, sensitive, and elegant system reflecting in many of its components not only the highest states-of-the-art but states-of-the-art which have not yet been reached. Many people ~~looking carefully and soberly~~ careful & sober at the SAMOS program are horrified when they look, not only by what they see in terms of complexity piled upon complexity but ~~are horrified at~~ by the notion that this was intended to be our first reconnaissance satellite. There is the feeling that we are orbiting before we are walking. And there is the matter of cost: The SAMOS Program, now approaching the billion dollar mark, can be compared with other projects. Hoover Dam, a mighty monument to man's engineering abilities, ~~strength,~~ and technology cost, start to stop at the order of 180,~~000,000~~ 1 & million dollars. The other day I learned that the entire cost of the St. Lawrence Sea Way, a gigantic project of the 1950's was approximately 400,~~000,000~~ million dollars, and to bring the matter even closer the TIROS Program cost approximately 12,~~000,000~~ million dollars (this is the RCA costs: 3 birds and ground receiving equipment). ~~Now much of what I have just said in the line of~~ Many of the historical remarks made above are found in several RAND publications which I will not now bother referencing; ~~much of~~ some of the other remarks can be found in a careful perusal of the 11?-L Advisory Committee reports; much of the evaluation and hard-nosed remarks I am sure you have heard and will likely continue to hear at various points, upwards and onwards in the chain of command and control on your project and your funds. ~~This then is a quick statement of the dilemma we think we are in.~~ INSERT "S" next pg I ~~have not yet mentioned subsystem~~ I,

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~~INTERPRETATION OF NEEDS, GUIDELINES, DIRECTIVES, ORDERS, ETC.~~

when physical ~~emergence~~ emerged & preferred recovery as a dominant technique in getting data back, the classic (or original) SAMOS system suddenly found itself being touted as a surveillance system. It would seem apparent that a television type system on orbit (with ~~was~~ limited total ~~capability for~~ daily data delivery ~~per day~~ rate) might be useful for ~~a tentative~~ repetitive coverage, for studying the dynamics of various ~~aerial~~ Soviet operations, for looking at things which require short intervals between looks XXX for full appreciation, etc. Now, although some of these notions were in the original SAMOS concept, they were ~~are~~ not emphasized as much as they had to be at this (latter) stage of the game. # In other words, classic SAMOS defaulted ~~and an ability to handle or produce~~ (to recovery with respect to production of) large amounts of data, and therefore had to find a new niche for itself. # This is all very interesting and many people, especially the writer, have insisted on the complementary nature of the two kinds of satellites and have insisted they are not really competitive. # However, two novel factors presented themselves at this time and really upset the apple cart. First, and probably dominant, is the fact that nobody, but nobody, really understands surveillance - how to do it, why to do it, its importance, real requirements for it, etc. This is a basic point, one which has already run through the entire SAMOS program and which will continue to be an open question for a long time to come. The reason why it will continue so this question cannot be answered by clever or facile studies, contractor XXXX reports, conjectures, and the like. It can only be answered by doing it. # The problem is how do we get around to do it if XXXXX its ultimate utility is questioned to begin with, With XXX possible cancellation of the only method available to indeed do surveillance. That is one aspect of the problem of surveillance and SAMOS. # The other fundamental aspect is that it seems to be extremely difficult to conduct the "modest" R and D program devoted to exploration, ~~and~~ study and development of surveillance philosophy, techniques, and technology: It just seems to cost too much the way things are going. The result again is that when those men of conscience who are also somehow responsible for dispensing money

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for this program are forced to choose between their natural scientific inclination to explore and study surveillance systems and ~~between~~ this fact ~~and their~~ of excessive costs for a massive commitment they may vote in favor of cancellation altogether.

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the data handling system. I think that dollar for dollar, sub-system for sub-system, SSI has irritated more people per square organization than any other single feature of the program. ~~This has~~ rightly or wrongly represented plushness, fancy living, extraordinary complexity, elaboration beyond necessity, ~~etc., etc.~~ ~~This is a brief summary of the dilemma and current problem. Next [illegible] of need [illegible]~~

~~INTERPRETATION OF NEEDS, GUIDELINES, DIRECTIVES, ORDERS~~

INTERPRETATION OF NEEDS, ~~EXXXXXXXXX~~ GUIDELINES, DIRECTIVES, ORDERS, ETC.

We are all familiar with the numerous detailed and strong points made by Billings about this program, having heard these in meetings, prior conversations, and briefings, extending over a considerable period. There is therefore no need to repeat these remarks in this letter. We have found it desirable and necessary to try to state a few guiding principles for ourselves in conducting our current look at SAMOS for you. ~~First~~ One, an early capability and demonstration ~~that~~ is better than a deferred demonstration Two, simplicity is preferable to elegance. Three, recovery is more important than readout. Four, backup to existing programs is ~~more important than parallel development of the same kind of systems.~~ should be real alternatives not duplication & should be alternatives with a gap Five, relatively long term R and D programs for next generation systems make sense only if they follow soundly conceived systems designed for early operations.

~~First~~ ONE:

TWO:

THREE:

FOUR:

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WHAT ABOUT THE E SYSTEMS ? wh @

E-1

Most of us know the sad history of ARPA's connection with this program. One part of this resulted in and the consequent need to smuggle in the 6 inch lens (E-1) into the F-1 ferret package. Under present conditions however new priorities would seem make it important to fly E-1 as soon as possible. In order to maximize the chances of success F-1 should either be removed, excised, disconnected or otherwise rendered impotent. I say this despite any possible assurances I might receive that operation of F-1 would not affect the operation of either one (E-1). It just ain't so! The next step that should be taken is for Eastman Kodak to pick an average focus and an average image motion compensation setting, lock the controls, throw away the key and indulge in a minimum of conversation with the machine if (when) it gets on orbit. A small success will breed a large confidence and a large confidence will in turn breed a still larger success. I'd be very happy to see 20 or 30 or 40 examples of lines per millimeter from orbital photography, and I'm willing to wait a little while (maybe) for a hundred lines per millimeter (my private belief). But is that we will all have to wait a long time for a hundred lines per millimeter from this type of system. These suggestions are entirely apart from a long time previous suggestion made a long time ago (& repeated at frequent intervals) the exact status of which I don't seem to have in hand: taking out the miserable strip camera from the E series satellite payloads and replacing it with a 70 mm frame camera (with its own shutter). The reason why I keep mentioning the P-220 camera is that this camera or one just like it (the P-2) has successfully taken (photos showing) close to one hundred lines per millimeter from airplanes. It has the requisite shutter speed which will (to) permit ignoring IMC or paying little attention to it. and with this camera alternate films might be used. This point is explained at length in my B-166, a copy of which Colonel King has. Further, it is not now obvious to me that the stabilization system which winds up working in the E systems will have the same set of specifications and tight tolerances and small angular motions and rates that the original systems contemplated for the E payloads had. If this is the case (and then it always turns out this way) then this forces even closer attention to the problem of minimizing

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exposure time, which This simply cannot be done with the strip camera. I would personally like to see E-1 fly before E-2. If it works the other way we may never find out that E-1 photography may be quite useful and if we don't find it out there is never a chance of taking the steps necessary for securing more of this type of photography.

E-2

Because there are more scheduled E-2 flights scheduled than E-1 flights, the remarks I made immediately above about locking controls on focus and image motion compensation are even more pertinent for E-2. Modest success is essential and upon modest success rapid progress can be made. This is a cumbersome way of saying that 20 or 30 lines per millimeter from E-2 would really be a terrific, would be something that could be widely shown, would kindle enthusiasm where there is lack of enthusiasm now, and where there is modest interest now there would be much greater interest in this kind of activity. ~~Next we come to E-5~~

E-5

Now we come to a hard look at the E-5 system. To the many people who are as familiar with the SAMOS system as they can possibly get (they are allowed to and as with it seems incredible that the recovery being assigned number 1 priority, the first recovery program in the system is E-5. Let me summarize my feelings about E-5.

E-5 is a complex, intricate, heavy, advanced, sophisticated, elegant, piece of machinery which within the recovery program and possible systems that could be used for recovery, is as complicated, complex, as the E-2 system and is subject to the same criticisms & remarks. E-5 is the direct result of the tremendous improvements in the satellite resolution made in recent years entirely at the verbal and specification level ~~in recent years~~. I refer of course to the fact that people soon got tired of writing and listening to 100 feet ground resolutions (before ever having obtained it) soon started dwelling exclusively upon 20 foot ground

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resolution (and of course haven't gotten this yet either) and soon were forced to make the improvement to five foot ground resolution (at the ~~XXXXXXXXXXXXXXXXXX~~ conversational level). E-5 carries such a massive payload of film, requires such a long life for ~~its~~ operation, such a fantastic recovery operation that an overall ~~~~ of the entire system as being ~~really way out~~ is inescapeable. The only analogy that I can draw is the old one of the kid caught with his hand in a cookie jar. He won't let go of those delicious specs and he can't get operational because he insists on hanging on to the specs. It is not enough to say that this is a high risk program, because this statement is very much like all statements ~~XXXXXXX~~ involving calculated risks ~~for~~ which calculations are usually absent. If we accept the general agreement that recovery systems are more important than readout systems; that recovery systems must be made to work, we cannot ~~leave the major recovery system~~ the E-5. We are not suggesting that this program be cancelled or any drastic ~~stuff~~ like this but that it be ~~with~~ a sensible R and D effort ~~like~~ the recovery operation itself ~~and~~ a fairly interesting menu of alternate photographic systems. Examples of both of these suggestions and recommendations will ~~xx~~ follow subsequently.

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SURVEILLANCE — The central aspect of the readout argument.

Central to all recent discussions of SAMOS have been evaluations of readout versus recovery. It has been indicated in this letter, there can be no argument that recovery techniques can deliver volumes of data which outweigh and outnumber that obtainable by readout techniques by severals orders of magnitude. A simple calculation will make this point crystal clear. The 6 megacycles per second channel of the SAMOS system, if operated for one hour per day on readout can deliver the equivalent of a roll of film which variously estimated is of the order of 20 to 30 feet long by 70 millimeters wide with information typed on it and 100 lines per millimeter. It is not unreasonable to postulate an eventual recovery capability which could deliver 10,000 feet of 18 inch wide film or equivalent at nearly the same resolution. The relative amounts of information delivered is simply the ratio of the areas of film. And for the more or less extreme example I chose this ratio is 4500. What this says is that a readout system would have to operate for 4500 days to readout this quantity of information which could be stored on a 10,000 foot roll of 18 inch film. Now this calculation is not entirely fair, for I haven't said how long it takes to get the 10,000 feet of film. This may be several days or may be a month, depending on the focal length I happen to choose. The example is meant to be illustrative only, and whether right or wrong in small details is certainly correct and overwhelmingly so insofar as the major point it conveys. Defaulting as they do to the recovery systems when it comes to collecting huge quantities of data, readout systems have been forced to take refuge in tenuous arguments about surveillance. Let's look at these briefly.

Warning of imminence of attack has always been a high priority problem. Because of this fact and because of some (mistaken) beliefs that the E-2 system and systems like it could contribute mightily to the solution or solve the warning problem, they have

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been so advertised. A couple of years ago I pointed out to those advocates of this particular and privileged point of view that just as soon some truly sophisticated people elsewhere high in the Pentagon would get a very close look at this argument and realize its fallacious character, serious consequences might follow (such as cancellation). Such mutterings have been heard and continue to be heard. It does not follow of course, that because a satellite is on orbit continuously it can look at given points on a very close time mesh. The classic solution to this problem is to simply order more satellites and then order a giant computer to handle and sort and allocate problems to these satellites. This"solution" can (does) infuriate, exasperate, embitter, and aggravate the feelings of those who have doubts about readout altogether. Simply put, some people might say, look we don't even know how good one of these is and yet you tell us we have to have dozens of them. Are there then no problems for which readout is pecularily adapted? Of course there are problems for which readout is adapted. We can approach a consideration of this problem as follows:

Suppose the Soviets go to a mobile missile system of whatever variety. While it is not at all clear that any particular surveillance system we have within our imagination, ability, and funds to design and operate can "solve" this problem, it seems fairly evident to me that a slow paced recovery system operating with 100 per cent coverage twice a year (or on some similar cycle) will completely foreclose our ability to solve this problem. There are many other such problems, I will not bother to list them at this point. Unfortunately the only experience that I know of which the United States has had with surveillance has to do with front line cover under combat situations, an analogy which is at best imperfect and at worst irrelevant for the kind of peacetime surveillance over huge areas and for the different purposes we are herein considering. These experiences enjoyed by old combat recce hands are ancient; they are as remote from the present and immediate future as World War I were experiences from World War II. What is important it seems to me is that we use precisely this argument-that of open mindedness, of realization of our problems which we can not now specify as an argument for behaving

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in a ~~XXXXXX~~ manner which leaves a possible solution open and does not foreclose on them. Of course this means that surveillance efforts must be restricted to an appropriate R and D level, and that as we learn the technology and the value of surveillance we can indeed see where to go from there. There must be an intensive research effort to identify those problems which operate and exist in time cycles of a day, several days a week, a month, and so on. And which have observable components. Perhaps this can best be done by simulation or by direct test in the United States. The ~~dilemma~~ problem which you face if you believe the considerations just stated, is finding a method which lets you get a little practical satellite surveillance and then arguing that a little surveillance is a hell of a lot better than none at all.

What about ~~RECE~~ Reece satellites and warning? There is no denying that the output of ~~RECE~~ Reece satellites of whatever type might well contribute ~~for~~ to an understanding of the warning problem. It is extraordinarily difficult to find ~~people~~ people well informed in this business who take other than extremely dim views of the kind of standard patter one finds in briefings about ~~RECE~~ Reece satellites and what they are going to see at missile bases, etc. I ~~have found that~~ as I noted earlier, these discussions ~~as noted earlier~~ tend to exacerbate knowledgeable people (i.e. make them mad). And, for no other reason ~~they~~ such briefings should be discontinued. As a ~~surely~~ fairly novel point let me bring up something which I suggested several years ago - the orbital six-shooter. It is not a priori obvious that ~~readout~~ RECOVERY systems have to operate in a mode radically different from readout systems. For example, one can think of putting up a sizeable satellite on orbit with ~~an amount of~~ a load film ~~not~~ measured in the tens of thousands of feet, and with an ability to respond to commands, take whatever pictures are ordered and mail these back by space mail on direct command. This of course can be done by cutting of film, packaging it ~~into~~ in a cassette ~~the pot~~ and shooting it back. In principle at least, this kind of a recovery system meets some of the specs ~~repeats~~ and advantages of the readout system. It is certainly something to think about for advanced systems.

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NONPHOTOGRAPHIC ~~AND~~ RECONNAISSANCE AND SENSING

Although I am ~~an~~ old photographic hand I have come to have some measure of respect for understanding of ~~for~~ nonphotographic techniques. ~~It would seem likely that there are~~ certain classes of data, in particular ~~COMINT~~ ELINT, which, not requiring the fantastic bandwidth equivalent of recovery systems could well exploit and ~~not~~ be limited by the 6 megacycle bandwidth channel available from ~~xxx~~ satellites. It would seem clear that one could argue that ~~COMINT~~ ELINT data of a very advanced nature (suitable for technical intelligence) need not be secured on a near real time basis but could afford the luxury of precision recording, recovery, and comparatively slow evaluation. After all, what advantage is there in sending back data ~~at the speed of light~~ in a few minutes if it is going to take a few months to analyze it anyway? I ~~XXXX~~ raise these considerations in an almost random manner because they have not been part of recent discussions. For whatever reasons there seems there has been an almost exclusive concentration on photographic data. While this does not make me terribly unhappy I ~~wonder if~~ suspect it is not entirely fair. ~~The complete deprecation of~~ Secret data ~~poses the problem~~

The term "photographic data", ~~as~~ as herein used ~~includes~~ the use of ~~classical~~ photographic materials, really means & includes all image-forming systems working in the visual (essentially) portion of the spectrum. ~~These IR systems, electronic tape systems~~

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new techniques → new sensors, new vehicles, Annex A

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FUTURE R AND D PROGRAMS

We have indicatdd earlier some of the kinds of things which might be very interesting for future R and D programs. A much better treatment of this entire area will be found in the several Special Studies Committee reports, which I assume you have available. Very briefly, and in an attempt to make this particular report autonomous and readable, I can foresee these general areas which could probably stand profitable examination and which likely may prove extremely useful in the future. You will note (and I am therefore mentioning it early) that the validity many of these ideas require that we clearly think out the role of surveillance. And if we fail to completely think it out then we may not understand at least do such experimentation as will enable us to get answers which would indicate the future role of an expensive surveillance effort. With isolating separately although it really flows continuously from the ever increasing specs on resolution is the overall difficult & persistent problem of technical intelligence. ~~I noted elsewhere in this letter that~~ this looks ~~to me~~ like an area which will be of increasing and maybe even dominating importance in the mid 60's and late 60's. It may not be entirely foolish to think about (although it is quite foolish to plan at this time for) satellites capable of yielding resolutions bound down to one foot. This is likely to the class of resolution being needed for technical intelligence. The technical intelligence people, as I have noted many times elsewhere, really don't want pictures. They want the designer, project notebooks, blueprints, lab tests, development history, and the gadget itself. However these things are seldom available. Our satellites do not have grappling hooks; hence and to whatever extent their picture a photograph can satisfy the technical intelligence types people the picture must be of high quality. Resolutions measured in terms say of 6 inches to two feet are probably indicated in this mission.

It is quite likely that we can assign this mission to some truly huge satellites ~~which will be available in the future~~ whose with orbital weights measured in terms of tens future maybe of thousands of pounds. But first we ~~have got to~~ must learn how to take some much poorer pictures from orbit.

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INSERT "A"

New Sensors & New Techniques

The requirement for new sensor research and development stems from the basic limitation of the present photographic method -- we can take wonderful photographs on a clear bright day, but we can't take any through clouds or fog. We can barely take poor photos by moonlight.

Because a good part of the area of interest is under cloud a good part of the time, because the area is dark almost half the time, and because the northern areas, are dark for long continuous periods, our observational opportunities are sharply delimited.

Work should be done to make even more sensitive (faster) photographic emulsions, non-photographic (i.e., non silver halide) sensors, -- electrostatic tape, improved TV systems, and the like.

Radiation effects -- whether natural or enemy-induced may limit conventional film, and force use of other sensors.

Novel data handling techniques, which make more efficient use of available bandwidth are clearly interesting and should be pushed.

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One can talk about and do preliminary calculations which ~~might~~ indicate the feasibility of doing some kind of high resolution radar work from reconnaissance satellites. Infrared mapping systems (as ~~sustained~~ distinguished from ~~modest~~ MIDAS type infrared utilization) are probably feasible. On the other hand the argument for radar ~~for~~ infrared, hinges on requirements for seeing through bad weather, ~~from~~ for seeing at night or under conditions ~~from which~~ photography (or television) won't work. Here we come deeply and firmly back to the problem of surveillance; until and unless we are firmly convinced that we understand surveillance & that this mission is important, there would seem to be no point in urging high priority programs to achieve these capabilities. On the other hand there is considerable point in making a bet that such ~~characteristics~~ gadgets & techniques will eventually be useful, and that studies leading to design choices ~~are of interest~~ should be pursued.

A further comment is in order about the suggestion for new sensor R&D. These follow under a separate heading:

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BOMB DAMAGE ASSESSMENT and INSPECTION

A widely ignored but likely extremely important reconnaissance task is that of bomb damage assessment. It would seem almost intuitively clear that some kind of more or less fast cycling ~~in a~~ minimum time delay readout system would be far more ~~adaptable~~ useful for this purpose than would a recovery system. Although it is ~~also clear~~ likely that the latter could be used ~~xx~~ in some fashion for this purpose. ~~Further, nobody I am sure has thought out carefully exactly how~~ Although there has been some work indicating the potential utility of a reconnaissance satellite could ~~be used~~ in support of inspection activities, it is also true that ~~not~~ much more work needs be done. It also could be argued in principal that readout satellites launched fairly infrequently might serve a more useful function for spot checking and discovery of new things requiring detailed inspection than could recovery systems.

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22 Apr 53 – Strategic Missiles, Period 1958 & Beyond
Sect VIII – The Satellite & the Future : pp. 58-66

Feasibility suggested in RAND Series RA-15021 → 32 1 Feb 47.
1000-lb payload @ 350 mi. orbit. This was elaborated for
Recon in R-217 of Apr. 51
N. Amer Aviation studied orbital control
RCA studied TV system.
AEC power source for Sat. L 330-lb Nucl. Reactor. 1-kw.

12 Mar 56 – "RAND Recommendation to the AIR STAFF"
Photog. Recon. Satellites. TS-1426
Cover Letter to DCS Development (Putt)
signed by RAND Pres (Dir) F. R. COLLBOHM.
POLAR ORBIT

Brownlee W.
Haupaa
Rich C.
Raymond.

15 Aug 55 – Rand Research Memo.
Case Studies of Actual & Alleged
Overflights, 1930-53 – Alex. L. George RM-1349(5)

Studied 114 cases.
5 Oct 49
22 Oct 49

Dec 50 Kellogg to G Hadley on Balloons (Korean Work)
17 Feb 51 Balloon Recon. Proj @ ARC

4
30 | 120
120

20 Sep 51

Arnis per foot

TRIAX did RED PIPER competition

Rob't L. Perry History of Space Systems Div.

Ridenour did presentation for Lockheed RED PIPER.

Ridenour was DuBridge

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Not the best but something that worked

A. Katz wrote paper "Quick Fix: A new camera for WS 117-L

B-camera — only mirror rocks.
Baker designed C-camera 4 or 5 times. Payload comp. only 5' long. Q bay not well suited to high eff. coverage + weight consid.

①	②	③	④	5
240 →	180 →	144 →	120 →	180
			13x13	13x13 50° cov.

If compartment 12" longer no such probs
Stability critical.
early tests 5/10 l/mm

Merton Davies began invest spin-stab sats in Spring '57 after learning of Fairchild's pan camera.

Steering Comm
~~Met~~ @ RAND 14-15 Nov 57 ~~[illegible]~~ & again on 19 Dec 57.

27-30 Oct 57, Dunc Macd.'s Recon & Intel Panel of SAB met @ BMD to hear 117L group included Dick Raymond & Phil Strong, & Ernie Plesset(?).
Raymond talked on urgency of recon. & recon sats. (same as early '56) using Thor, small payload & vert. or small cov strip camera. Bad choice camera, to

120 mins @ 6 MHz data for 30 ft of 70 mm film @ 100 l/mm

At Stan use Studies Wm R Harris March Crisis 48 Act I & II 1966-67
S/NF. Vols 10 & 11

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